

**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
(Chapter II of the Patent Cooperation Treaty)  
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>FP21168</b>	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. <b>PCT/AU2005/000192</b>	International filing date (day/month/year) <b>16 February 2005</b>	Priority date (day/month/year) <b>16 February 2004</b>	
International Patent Classification (IPC) or national classification and IPC  <div style="display: flex; justify-content: space-between;"> <span>Int. Cl.</span> <span><b>C22B 3/36 (2006.01)</b></span> <span><b>C22B 3/28 (2006.01)</b></span> </div> <div style="display: flex; justify-content: space-between;"> <span></span> <span><b>C22B 3/26 (2006.01)</b></span> <span><b>C22B 21/00 (2006.01)</b></span> </div>			
Applicant <b>TECHNOLOGICAL RESOURCES PTY. LIMITED et al</b>			

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of 6 sheets, as follows:

☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) containing a sequence listing and/or table related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/> Box No. I	Basis of the report
<input type="checkbox"/> Box No. II	Priority
<input type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/> Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/> Box No. VI	Certain documents cited
<input type="checkbox"/> Box No. VII	Certain defects in the international application
<input type="checkbox"/> Box No. VIII	Certain observations on the international application

Date of submission of the demand <b>16 September 2005</b>	Date of completion of this report <b>08 May 2006</b>
Name and mailing address of the IPEA/AU <b>AUSTRALIAN PATENT OFFICE</b> <b>PO BOX 200, WODEN ACT 2606, AUSTRALIA</b> <b>E-mail address: <a href="mailto:pct@ipausttralia.gov.au">pct@ipausttralia.gov.au</a></b> <b>Facsimile No. (02) 6285 3929</b>	Authorized Officer  <b>DAVID K. BELL</b> <b>Telephone No. (02) 6283 2309</b>

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2005/000192

## Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☒ The international application in the language in which it was filed
- ☐ A translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3(a) and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1 to 10 as originally filed/furnished

pages\* received by this Authority on \_\_\_\_\_ with the letter of

pages\* received by this Authority on \_\_\_\_\_ with the letter of

☒ the claims:

pages as originally filed/furnished

pages\* as amended (together with any statement) under Article 19

pages\* 11 to 16 received by this Authority on 20 April 2006 with the letter of 20 April 2006

pages\* received by this Authority on \_\_\_\_\_ with the letter of

☒ the drawings:

pages 1/1 as originally filed/furnished

pages\* received by this Authority on \_\_\_\_\_ with the letter of

pages\* received by this Authority on \_\_\_\_\_ with the letter of

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (specify):
- ☐ any table(s) related to the sequence listing (specify):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (specify):
- ☐ any table(s) related to the sequence listing (specify):

\* If item 4 applies, some or all of those sheets may be marked "superseded."

**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims 1 to 25	YES
	Claims	NO
Inventive step (IS)	Claims 1 to 25	YES
	Claims	NO
Industrial applicability (IA)	Claims 1 to 25	YES
	Claims	NO

**2. Citations and explanations (Rule 70.7)**

D1 = AU 200154474 A1

The invention as defined in the present claims is a process of producing aluminium and aluminium-containing materials by leaching a solid aluminium-containing feed material to form an aqueous solution, extracting the aluminium ions from the aqueous solution by contacting the solution with an organic reagent to form an aluminium complex and recovering aluminium-containing material from the aluminium complex.

The cited document D1 does not disclose a process have these features. The claimed invention is therefore Novel, has an Inventive Step and is Industrially Applicable

CLAIMS:

1. A process of producing aluminium and aluminium-containing materials from a solid aluminium-containing  
5 feed material that comprises:
  - (a) leaching the aluminium-containing feed  
10 material with a leach liquor and forming an aqueous solution containing aluminium ions;
  - (b) extracting aluminium ions from the aqueous  
15 solution by contacting the aqueous solution with an organic reagent and loading aluminium ions onto the organic reagent and forming an aluminium complex;  
and
  - (c) recovering aluminium or an aluminium-  
20 containing material from the aluminium complex.
2. The process defined in claim 1 wherein the  
25 aluminium-containing material comprises any one or more of alumina, aluminium hydroxide, aluminium trihydrate, and aluminium chloride in any suitable solid form.
3. The process defined in claim 1 or claim 2 wherein  
30 the recovery step (c) comprises displacing aluminium ions from the aluminium complex by contacting the aluminium complex with an aqueous solution and thereafter recovering aluminium or the aluminium-containing material.

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4. The process defined in claim 3 wherein the solution used in step (c) is a more acidic solution than the initial leach liquor used in step (a) and has limited solubility for aluminium and step (c) comprises displacing  
5 aluminium ions from the aluminium complex by precipitating the solid aluminium or the aluminium-containing material from the solution.

5. The process defined in claim 4 wherein step (c)  
10 comprises recovering the precipitated solid aluminium or the aluminium-containing material from the solution.

6. The process defined in claim 3 wherein the solution used in step (c) is an acidic solution and step  
15 (c) comprises displacing aluminium ions from the aluminium complex into solution.

7. The process defined in claim 6 wherein the acidic solution is a hydrochloric acid solution.

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8. The process defined in claim 7 wherein the hydrochloric acid solution has a pH of 1-6.

9. The process defined in any one of claim 6 to 8  
25 wherein step (c) comprises recovering the solid aluminium or the aluminium-containing material from the solution by heating the solution and causing thermal dissociation to drive off water and hydrochloric acid in gaseous forms and producing alumina in a solid form.

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10. The process defined in claim 6 wherein step (c) comprises recovering the solid aluminium or the aluminium-

containing material from the solution by transferring aluminium ions into an ionic liquid.

11. The process defined in claim 10 comprises  
5 recovering aluminium from the ionic liquid.

12. The process defined in claim 11 comprises recovering aluminium from the ionic liquid by applying a potential across an anode and a cathode positioned so that  
10 at least the cathode is in contact with the ionic liquid and depositing aluminium on the cathode.

13. The process defined in any one of claims 10 to 12 comprises transferring aluminium ions into the ionic  
15 liquid directly from the solution.

14. The process defined in claim 13 wherein the ionic liquid is hydrophobic with a high affinity for aluminium and is stable in the presence of water.

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15. The process defined in any one of claims 10 to 12 comprises transferring aluminium ions into the ionic liquid indirectly from the solution.

25 16. The process defined in claim 15 comprises transferring aluminium ions from the solution contained in one compartment into the ionic liquid contained in another compartment via a membrane, diaphragm or other suitable means that is permeable to aluminium ions and separates  
30 the compartments.

17. The process defined in claim 16 wherein the driving force for the transfer of aluminium ions from the

5 compartment containing the solution to the other  
compartment containing the ionic liquid is either by  
concentration gradient or by having an anode in the  
aqueous compartment and a cathode in the ionic liquid  
compartment.

18. The process defined in claim 3 wherein step (c)  
comprises displacing aluminium ions from the aluminium  
complex by precipitating solid material, dissolving  
10 precipitated solid material in an ionic liquid directly or  
indirectly, and recovering the solid aluminium or  
aluminium-containing material from the ionic liquid.

19. The process defined in claim 3 wherein step (c)  
15 comprises displacing the aluminium ions directly from the  
aluminium complex by transferring aluminium ions into an  
ionic liquid and recovering aluminium from the ionic  
liquid.

20. The process defined in claim 19 comprises  
recovering aluminium from the ionic liquid by applying a  
potential across an anode and a cathode positioned so that  
at least the cathode is in contact with the ionic liquid  
and depositing aluminium on the cathode.

21. A process of producing aluminium and aluminium-  
containing materials from a solid aluminium-containing  
feed material that comprises:

30 (a) leaching the aluminium-containing feed  
material with a leach liquor and forming  
an aqueous solution containing aluminium  
ions;

- 5 (b) extracting aluminium ions from the aqueous solution by contacting the aqueous solution with an organic reagent and loading aluminium ions onto the organic reagent and forming an aluminium complex; and
- 10 (c) recovering aluminium from the aluminium complex by displacing aluminium ions from the aluminium complex into solution by contacting the aluminium complex with an aqueous solution, thereafter transferring aluminium ions into an ionic liquid, and thereafter recovering aluminium from the
- 15 ionic liquid.

22. The process defined in claim 21 comprises recovering aluminium from the ionic liquid by applying a potential across an anode and a cathode positioned so that

20 at least the cathode is in contact with the ionic liquid and depositing aluminium on the cathode.

23. A process of producing aluminium and aluminium-containing materials from a solid aluminium-containing

25 feed material that comprises:

- 30 (a) leaching the aluminium-containing feed material with a leach liquor and forming an aqueous solution containing aluminium ions;
- (b) extracting aluminium ions from the aqueous solution by contacting the aqueous



solution with an organic reagent and  
loading aluminium ions onto the organic  
reagent and forming an aluminium complex;  
and

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- (c) recovering aluminium from the aluminium  
complex by displacing aluminium ions from  
the aluminium complex by transferring  
aluminium ions into an ionic liquid and  
thereafter recovering aluminium from the  
ionic liquid.

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24. The process defined in claim 23 comprises  
recovering aluminium from the ionic liquid by applying a  
potential across an anode and a cathode positioned so that  
at least the cathode is in contact with the ionic liquid  
and depositing aluminium on the cathode.

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25. An aluminium or aluminium-containing material  
produced by the process defined in any one of the  
preceding claims.

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